“UNDERSTANDING HUMAN CAPITAL THROUGH MULTIPLE DISCIPLINES: TENNESSEE’S EDUCATIONAL NEEDS INDEX”

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INTRODUCTION

For several decades, scholars have stressed the need for academics to become more involved in policy relevant research (Keller 1985; Conrad 1989; Nettles 1995: Terenzini 1995). As Keller (1985) notes, most of the research in higher education is preoccupied with methods, neglects educational policy, and is written for other researchers rather than those who must act. This shortcoming is especially glaring in the area of addressing the link between the educational needs of local communities and their economic opportunities. Although the field of human capitol theory (Schultz 1961; Becker 1964; Denison 1967) has provided great theoretical insight into this area, few studies have provided a direct link between educational attainment and the economic and social welfare of counties. Such information is critical to policy makers as they attempt to develop strategies to improve the general social welfare of citizens across the nation.

Scholars (Weiss 1972; Meltsner 1976; Gordon 1992) have increasingly called for a greater nexus between academic research and public policy development, formulation, and implementation. Although there is general acceptance in the field with respect to the need for higher education to play a vital role in the policy-development process, there are few examples of this movement at the upper strata of the decision making process. This article attempts to fill this void through the creation of an indicator-based model that measures the potential value of investments in higher education in Tennessee. As Blank (1993) posits, education based indicator models have the potential to provide a dependable picture of the status of investments in education and can be used to provide a valid basis for assessing ways to structurally and functionally improve education.

This research incorporates the model construction framework identified by Blank (1993), which recommended that education based indicator models concentrate on elements of the educational system that are most likely to have pervasive effects on educational outcomes. The authors have also worked diligently to ensure that the model "clearly defines issues and produces interpretable policy conclusions" (Hunt, Rose, and Scott 2000). In order to achieve the desired nexus between research and adoption/implementation, it is imperative that top-level commitment to the project be obtained from the onset of the development process. Furthermore, indicators must be reported in a format that is uncomplicated and can be comprehended by different audiences, as all levels of the education system have placed increased attention on the topic of education indicators.

The purpose of this research is to develop an econometric model that provides direct evidence of the link between education and social welfare. Through a focus on the external benefits of education, we will demonstrate the causal link between educational attainment and social welfare in the 95 counties across Tennessee. This research is critical for states such as Tennessee in which less than 17% of the population holds a college degree and large portions of the general population live below the poverty line. Underdeveloped states, such as Tennessee, must rely upon education to provide the cornerstone for all economic development activities. Only through increasing the educational attainment of its citizens can Tennessee reach its full economic, social, and cultural potential.

THEORETICAL FRAMEWORK

Human capital theory suggests that individuals and society derive economic benefits from investments in people. The theoretical construct presents a cost benefit analysis of the impact and benefit of higher education on individuals and societies. Human capital theorists have demonstrated that education amounts to an investment that generates a particular form of capital: human capital. This investment feature differentiates human capital expenditures from consumptive expenditures, those expenditures that provide few benefits beyond immediate gratification (Vaizey 1962). Human capital theorists assert that education increases the "human capital stock" of individuals, improves their productivity, leads to increases in economic productivity, and contributes to the general betterment of society (Denison 1983; Walberg and Zhang 1998). As Becker (1964) demonstrated, education is a powerful individual and social lever that government can manipulate to improve overall societal conditions.

Although there is disagreement in the scholarship with respect to the relative impact of various years of education on human capital (Schultz 1963; Johnson 1993), it is safe to assume that education increases and improves the economic capabilities of individuals and societies (Sweetland 1996). This theory has enabled economists to develop models that measure the impact of education on the general labor force (Denison 1967; Jorgenson 1984; Jorgenson and Fraumeni 1992). Human capital models have been particularly useful for studying economic development in countries in which education is a centerpiece of growth and development planning (Lee, Liu, and Wang 1994). As Sweetland (1996) notes, a research agenda that includes human capital theory applications is essential to supporting the educational policy process.

Research in the area of human capital theory is derived from the basic econometric model posited by Kuzents (1955). Kuzents suggested that as economies develop, income inequality tends to increase, reach its peak, and then decline. His seminal work produced the inverted-U hypothesis, which has been used by educational theorists to estimate the economic returns provided by increased years of schooling. At the broadest level, the wealth of a society is determined by the potential of its citizens. As the ability of this citizenry to contribute to the national economic production function increases, general social welfare also increases. Thus, as skill in the labor force increases, the greater the ability of that labor force to contribute to economic growth. Human capital theory clearly demonstrates that the most efficient means to improve the capabilities of a labor force is via education.

Benefits of Investments in Human Capital

Human capital theory has been validated by countless economic studies. The seminal research in the field is that of Schultz (1961), whose work earned him the 1979 Nobel Prize in Economic Sciences. Schultz made two profound observations that became the foundation of the field: [1] a significant proportion of the economic growth in the United States from 1900-1956 was unaccounted for by conventional economic means of measurement, and [2] a significant proportion of personal income growth was accounted for by increased levels of education. Later studies (Abramowitz 1962; Dennison 1962) showed that the impact of education on societal economic growth was clearly defined by the residual of traditional economic inputs. Denison (1962) noted that this residual, human capital investments, accounted for 43% of national income growth in the 1950's. Although Dennison's estimates were later shown to be overly optimistic, investments in human capital are generally accepted to produce a ten- percent margin of return (Sweetland 1996).

Increased educational attainment levels also result in a greater rate of overall consumption of goods and services. Barro (1997) found that raising the average level of schooling of the male labor force by one year increases the growth rate of GNP by as much as one percent. Levels of educational attainment have also been shown to influence greater spending on items such as housing, food, and transportation. As previously noted, economic expansion in our knowledge-based economy is driven by increased educational attainment. Furthermore, greater productivity has been the by-product of efforts to invest in human capital. Workforce flexibility and productivity enable strong economic systems to maintain momentum while adapting to changes in technology and the environment.

Tinbergen (1971) found that an increase in years of education contributed to a reduction in the degree of income inequality. Marin and Psacharopolous (1976) found that one extra year of education is correlated with a ten- percent decrease in income inequality. Furthermore, Bourguinioan and Morrison (1990) found that increases in educational attainment levels result in increased income attainment capabilities for all social strata, but this difference is most significant for those individuals in the bottom third of the wage differential scale.

Several auxiliary benefits also accrue from raising educational attainment levels. Society as a whole benefits from a more educated populace in ways other than just fiscal returns. Crime rates have been shown to decrease as the rate of education increases (IHEP, 1998). Education is also the driving force in preparing citizens for participation in political, economic, and social aspects of their communities. Bachelor's degree holders are 40% more likely than high school graduates to be a member of a community organization, 28% more likely to vote in national or state elections, and 90% more likely to contribute money to a candidate or political cause associated with education attainment.

Human capital theorists have demonstrated that there is a direct inverse relationship between education and poverty. In their study of societal health and welfare conditions, Curtin and Nelson (1999) found that primary schooling is shown to reduce the incidence of poverty by ten percent as compared to households whose heads have no little or no formal education. Furthermore, one extra year of schooling decreases the probability of poverty by 1.6%.

Educational attainment has also been shown to have a positive impact on the health and social well being of communities. Neonatal mortality rates also decrease as educational attainment increases (Curtin and Nelson 1999). Several studies (Gibson 1996; Harrison1997) have demonstrated that increases in educational attainment have the primary impact of promoting health and reducing societal mortality rates.

Human capital investments have also been shown to have measurable micro-level effects. Goldsmith et al (1997) demonstrated that human capital positively impacts psychological capital and impacts individual productivity levels. Psychological capital includes factors such as perceptions of self, attitudes toward work, ethical orientations, and outlook on life. Goldsmith etl al (1997) found that increases in individual educational attainment produced increased psychological capital, which corresponds with increased worker productivity and economic production capacity. Thus, not only does education produce skills, it produces well being.

A final auxiliary benefit received from investments in education is a decreased participation rate in social welfare programs (IHEP, 1998). Participation in programs such as welfare, food stamps, medical assistance, and housing assistance decreases as the level of education attended increases. In 1996, 25 to 34-year olds who completed 9-11 years of high school were three times more likely than high school graduates to receive income from public assistance programs. For those persons who completed the bachelor's degree, the percentage of participants in public assistance dropped to 0.4 percent (NCES 1998).

Limitations of Human Capital Theory

Although the research detailed above has been successful at describing the economic impact of education, it still suffers from several shortcomings with respect to the generalizability of the results. With the exception of studies by Smith (1987) and Levine (1985), there has been very little attention paid to the relationship between education and social indicators at the county level. As Beaumont and Isserman (1987) note, this deficiency is due primarily to the lack of valid indicators available at the county level. Another problem related to their development is that such models are often expensive to construct, difficult to use, and rely upon overly complex statistical assumptions (Beaumont and Isserman 1987; Walberg and Zhang 1998). In order for a policy nexus to be achieved, researchers must carefully monitor data quality, availability, and strive to ensure that their models are not overly complex (Mercenier and Yeldan 1999).

Another criticism of studies and models based upon human capital theory is that the methodology is interesting as a description of the past, but should not be used to predict the future (Benson 1978). Because of this limitation, many human capital studies are purely descriptive and provide few bottom line answers or solutions to societal problems. Further compounding the issues addressed above are concerns generated by the very nature of the questions asked in this research. Questions regarding the economic impact of education are often overly generalistic, and as Murnane (1987) notes, it is difficult to achieve a research/policy nexus in such circumstances. The authors have diligently worked to overcome many of the concerns noted in the literature. Through the use of an innovative data set, we are able to overcome the complexity concerns of Mercenier and Yeldan (1999) while at the same time keeping the indicators simple so that they can be used by policy makers.

Human Development Indices

Indices based upon various social, economic, and political concerns are very common in the literature and have become increasingly popular among scientists and policy makers concerned with measuring human capital and quality of life (Eisner, 1994; Lind, 1992; Jordan, 1992; Larson, 1994; Majumder, Mazumdar, & Chakrabarti, 1995; Diener, 1995). Aggregate measures of economic wealth and development are used by the United States and other nations to gauge and predict a variety of income and product accounts (Eisner, 1994). One of the most prominent of these measurement tools is the Gross Domestic Product (GDP). This leading index of economic health is primarily a combination of smaller indices that gauge various aspects of production and income earned (1994). The health care field also offers leading indicators and indices that attempt to monitor data on vitality, well-being, environment, and public health activities (Larson, 1994). Other more social and education based indicators such as the Human Development Index (Lind, 1992), Physical Quality of Life Index (Morris, 1979), Victorian Index of Children and Youth (Jordan, 1992), and Quality of Life of Nations (Diener, 1995) involve construction of social, economic, educational, and cultural indicators of human development. Though all indices are subject to scientific, professional, and political scrutiny and debate, they each offer a useful purpose in allowing for the "description of the relative position of nations [or locales] at a given time" (Lind, 1992).

As noted above, gross domestic product per person is a prominent example of an index of economic health, but it also is representative of a chief limitation in comparing nations or locales upon solely economic variables. Lind (1992) examined the growing use of composite indices that include other "development" measures such as education, health, or welfare. Terms such as "quality of life" entered the social science vocabulary in the 1950's and 1960's and indicators of living conditions have become "tools for understanding life in a variety of settings" (Jordan, 1992, p. 260). Indices such as these can be very powerful long-range planning tools as well as central vehicles of policy influence (1992). Specific to Lind's research is an examination of the Human Development Index (HDI), a unit of analysis created by the United Nations Development Program to rank nations (1992). Its central components provide for a comprehensive measurement of longevity, literacy, and command over resources needed for a decent living as measured by life expectancy, adult literacy, and real GDP per capita (1992). To establish comparable data across variables, statistics from each of these three indicators are converted to standardized scores relative to the range of each indicator grouping. These standardized scores are then averaged to create each country's HDI score (1992). In similar fashion, Johnston (1988, as cited in Jordan, 1992) included twenty-one indicators of economic and social concern to gauge quality of life in the U.S. Both Johnston (1988) and Jordan (1992) construct spheres (or factor categories) in which to organize all of their indicators. In Jordan's Index of the Quality of Life, he places twelve total variables into health, economic, and social domains and then provides rationale for selection of each variable according to its value to measurement of its domain (1992). This creation of domains (or factor categories) fulfills the suggestion that an index be developed so that it may be subdivided into practical components for decision making and be used as an overall benchmark to track progress (Larson, 1994).

In addressing the argument of simplicity versus complexity, Lind (1992) states that for compound indicators it is generally easier to explain a concept with fewer variables. However for a concept as complex as human development, it is sometimes necessary to include a broad set of possible indicators (1992). Even with rather broad criteria for inclusion, construction of the index may be limited by available choices of comparable data or by variations in the methods of measurement. Lind suggests that proponents of the index approach make clear the overall goal of the index, establish a finite set of indicators, and evaluate data elements through regression analysis to obtain a reasonable number of variables (1992). Likewise, Jordan (1992) states the importance of data accuracy and measures the correlation of each of the twelve variables in his quality of life index. He achieves this by calculating the correlation of each indicator relative to their respective domain index score and then to his overall VICY index score. In the end though, the construction of a particular index will involve making "assumptions and presumptions [about the individual indicators] that must be justified" (Lind, 1992, p.98).

Anecdotes and other situational data are largely abandoned in index development in favor of empirical rather than anecdotal evidence (Jordan, 1992). Generally, economic and demographic indicators are at least given credence due to their strong measurement validity. For example, the GDP and its associated components are generally accepted indicators of a nation's (or locale's) wealth. Economic indices, in particular, offer largely unambiguous data measurement and relieve the researcher from making value judgements (Eisner, 1994). Because of this reliability these indices become excellent patterns to replicate, or at least consider, when developing human development models.

Diener (1995) spends considerable time addressing the subject of data selection and index construction surrounding human development and quality of life. He lists several shortcomings to the existing quality of life measurements beginning with the fact that most, if not all, variables are chosen in an "unsystematic and atheoretical manner" (Diener, 1995, p. 108). He points out that there is no method for determining the correct set of variables (or general categories of variables) and no procedure for resolving disagreements between researchers and policy makers (1995). As he states, even the well-respected Human Development Index of the UNDP has no method for proving that it has the correct variables in its construct of national living conditions and potential. Second in his list of index shortcomings is the fact that most indices are only sensitive to differences between locales at one stage of development (1995). For example, wealthier nations bunch together at the top of a range because they all have similar economic, educational, and cultural variables and thus do not display the "differences" of their developing counterparts. Diener's third limitation to current indices is that most are based on rank-orders rather than on absolute values (1995). This statistical approach makes some locales appear to be more different than their data would show. Finally, he criticizes those indices that include indicators and/or categories that are not accepted universally as pertinent to discussions of human development or quality of life (1995). Once again Diener displays his frustration that indices are developed with very little attention given to the theoretical foundation available in the literature. Diener cites the work of Schwartz (1992) in which a comprehensive list of forty-five values accepted (through the literature) is used to represent universal requirements of human existence. Schwartz found that even though cultures varied on how each factor was emphasized, all forty-five echoed some importance either from the literature on each culture or from nominations from researchers on each culture (Schwartz, 1992, as cited in Diener, 1995).

Beyond the initial selection of proper indicators is the difficulty of weighting indicators and factor categories if employed. When combining data to form an index, the weighting is generally "tentative and subjective…with very little universal agreement" (Larson, 1994, p. 268). Unlike predictive models that allow for statistical validation of independent variable effects on dependent variables, an index primarily serves as a combined gauge of certain characteristics at one point in time. In addition to choosing weights according to generally accepted theory as suggested by Diener (1995) and Schwartz (1992), Larson (1994) offers another approach to justification of weights within indices. In his development of an International Health Status Index, he distributed a questionnaire to noted scholars asking them to weight health status variables on scale according to their importance in determining the overall health of a nation (1994). Mean values from these responses offered a possible standardized index totaling 100 percent. Though there was considerable debate and disagreement, Larson found through this exercise that the weighting of a global index was not totally subjective as scholars appeared to generally agree on appropriate weights (1994).

One last major limitation of most human development measures is their reliance upon national statistics rather than providing a local picture of conditions (Hechter, 1971 & Mills, 1978, as cited in Jordan, 1992; Lind, 1992; Jordan, 1992). This level of data aggregation does not accurately reflect the cultural, economic, political, and geographic differences of a nation and therefore does allow researchers to target the areas with greatest needs. Studies which measure living and economic conditions at a local level will come closer to recognizing the range of circumstances being faced by the citizens and development barriers to efforts for intervention (Jordan, 1992).

Practical Applications – Educational Needs Index

Tennessee's geographic and demographic diversity provides challenges to those planning for the delivery of private or public goods and services. The postsecondary education enterprise is greatly influenced by the political, economic, and cultural forces within the state, but most often its planning mechanisms fall into a "one-size fits all" pattern relying upon the consumer to initiate a relationship. Tennessee's universities, community colleges, and technology centers have much to offer the citizens of the state. Higher education does a fine job in tying its educational and technical resources to the demands of proactive members of society who value and desire further education and/or training. However, the true needs of those citizens "in the margin" are not always considered when planning for delivery of postsecondary opportunities.

Education and training are not just consumer goods that benefit those citizens who seek them out, but also represent wise investments by the state in the human infrastructure that makes up our economy. It would be beneficial for policy makers to better understand those areas of the state where a wise investment of time and fiscal resources could be made. Through the creation of the "Educational Needs Index," the citizens of counties whose economic and demographic characteristics indicate great need or demand for educational "investment" are identified to enable much more informed decisions about the resources required of the postsecondary enterprise.

Governmental policies play a significant role in influencing the growth rate of economies across nations, states, and localities. Those communities that make prudent investments in education will have a healthier and wealthier citizenry than those that do not. Additionally, communities who invest in education will attract industry which relies upon a skilled labor force, further perpetuating development. The scenario above further validates the position of Jha and Sahu (1997) that the only means through which societies can better themselves is through investments in education.

Several core principles have guided the Educational Needs Index development. First is the knowledge that the state budget of Tennessee is challenged by poor revenue growth; therefore, scarce resources and increasing demands for accountability in an era of a funding crisis requires informed decisions in allocation of those resources. Second is the awareness that education and the economy are increasingly intertwined as human capital becomes a centerpiece of the information economy. Private sector success hinges as much upon "what you know" as much as it does upon "what you do." The third core tenet is that educational planning indicators need to be linked with economic and demographic variables to provide a legitimate representation of our citizens. Education - whether elementary, secondary, or higher - does not function in a vacuum; therefore, decisions should not be made as if population patterns, labor dynamics, or income disparities do not exist. Finally, this research acknowledges that the demographic characteristics of Tennessee are not uniform from region to region. The social and economic conditions of those citizens who live in Nashville or Memphis are very different from the opportunities and challenges found in some of the rural areas of Tennessee. Postsecondary education planning should not continue to act as if the entire state will react the same way to policy initiatives. The current use of only state-level indicators in the planning process limits the ability of planners to differentiate between the various regions of the state.

Methodology

The methodology utilized in this research is built upon the work of Todaro (1977) and his analysis of developmental policy and population growth. Todaro measured the impact of various economic and social variables on the poverty rate of poor and developing countries. His index of development included factors such as per capita income, GNP, household income, birth rates, and education. These variables were assimilated into a "poverty index" which was used to compare various nations across the globe and tied their index ratings to policy and planning at the national level. Other examples are found in the literature of establishing indices through standardized data to achieve inter- and intra-country comparisons along conditions of wealth, industrial activity, social problems, etc. (Faul and Hudson 1997; Park 1997; Dixon and Menon 1997).

This research follows Todaro's basic foundation, but contains a higher level of data specificity and a much more detailed theoretical model. Our model includes county-level variables that directly impact participation rates in postsecondary education, educational attainment levels, employment patterns, and socioeconomic status. The indicators have been carefully chosen to allow for a manageable data pool, inclusiveness of relevant economic and social indicators, and control of redundancy (Walberg & Zhang 1998). The goal of this research was to combine various statewide educational, demographic, and economic characteristics and to provide comparisons of Tennessee's 95 counties. The index approach to determining the educational needs and demands of the 95 counties in Tennessee allows for many economic, educational, demographic, and social variables to be included in the analysis. Our model employs eighteen unique indicators that are folded into four factor categories: educational, economic, growth, and market. Employing Gaussian based statistics to standardize county-level variables, this index classifies those counties whose demographic and economic characteristics display the greatest need and/or demand for increased efforts to deliver education and remove participation barriers.

Using the data selected, we form a generalized educational needs index as follows:

$I = f_1w_1 + f_2w_2 + f_3w_3 + f_4w_4$

where,

I = a weighted index of the educational needs of a county relative to the other 94 counties in Tennessee as measured in z-score statistics;

$f_i^{\,i=1,2,\ldots,n}$ = the average z-scores of the individual indicators within each of four factors impacting measures of educational need;

$w_i^{\,i=1,2,\ldots,n}$ = the weight assigned to each factor. The sum of all w_i's must equal one.

Each of the four factors ($f_i^{\,i=1,2,\ldots,n}$) representing data elements that gauge the educational needs of a county are constructed as follows:

$f_i = (z_1 + z_2 + \ldots z_n) / n$

where,

$f_i^{\,i=1,2,\ldots,n}$ = an average of the z-scores of those indicators within each factor category;

$z_i^{\,i=1,2,\ldots,n}$ = the county's z-score for each indicator of educational need.

In short, averaging the z-scores of the factor's core indicators generates each factor (or category) score. These normalized values for each factor are then used in the overall "educational needs index" formula (summarized below) to determine a county's overall educational needs when relevant educational, economic, and demographic data are considered together. Data weights are assigned to each category according to the relative importance of each factor in gauging need, as well as demand, for postsecondary education and training.

OVERALL EDUCATIONAL NEEDS INDEX =

(EDUC)(0.4) + (ECON)(0.25) + (GROWTH)(0.2) + (MARKET)(0.1) + (POP. ADJ.)(0.05)

Collapsing twenty indicators of educational need and demand into five factor-categories (education, economic, growth, market, and population) allows each county to be profiled and an overall index score to be calculated. Rankings in each of the five categories are possible as well as the rankings of the counties' overall index scores. This process provides the rankings of all counties relative to one another and further informs the debate of where scarce educational resources could be best applied.

The tables and text that follow illustrate the various demographic and economic indicators utilized in our model. Each indicator, along with its rationale for inclusion, is listed within the five factor categories of most concern to Tennessee's postsecondary education planning: education levels; economic conditions; population growth patterns; current market characteristics; and total population.

Educational Factors (40% of ENI)	
Indicator	**Rationale for Selection**
Percent of the population 25 and older with a high school degree	To provide a snapshot of the high school degree attainment level of the adult population
Percent of the population 25 and older with a bachelor's degree	To provide a snapshot of the baccalaureate degree attainment level of the adult population
Average ACT Scores	To provide a standardized measure of academic achievement and abilities of secondary graduates
Participation of 18-44 population in Tennessee higher education	To provide a measure of the county's participation rate in 2-year and 4-year higher education opportunities in Tennessee...The age bracket chosen (18-44) represents the ages of 95% of higher education participants in Tennessee.

Educational Factors. This category seeks to determine present educational conditions, degree attainment levels, and participation patterns in postsecondary education in Tennessee. According to the Current Population Survey of the U.S. Census Bureau taken in March 1998, 76.9 percent of the persons 25 years old and older in Tennessee possess a high school diploma or higher. This figure is almost six percentage points behind the national average of 82.8 percent. Tennessee lags even further behind the national average for bachelor's degree attainment. In Tennessee, 16.9 percent of the population possess a bachelor's degree, compared to 24.4 percent of the U.S. population. The educational indicators chosen for each county serve as the cornerstone of the entire index project. Again, the four indicators of educational "need or demand" employed here are converted to z-scores and averaged into an overall score labeled the "Educational Factors Score" for that county. Especially in light of the need for this index to determine the need and market demand for educational intervention, this category is assigned the most weight of our four factors and represents 40 percent of the overall index score.

Economic Factors (25% of ENI)	
Indicator	**Rationale for Selection**
Average unemployment over four-year period of time	To provide a direct measure of the workforce dynamics facing the county
Percent of population under 18 in poverty	To provide a measure of the poverty level faced by children in the county
Percent of population in poverty	To provide a measure of the general poverty level faced by all residents of the county
Median household income	To provide a measure of the family income for those households in the "middle of the pack"
Per capita income	To provide a measure of income per person in the county...Statistic is different from "median household income"

Economic Factors. This factor category includes indicators of labor and income levels in each of the 95 counties. Within this category, the data attempts to gauge economic variables and compare conditions relative to the rest of the state. The economic indicators when averaged together represent 30 percent of the overall index score.

Growth Factors (20% of ENI)	
Indicator	**Rationale for Selection**
Projected population growth from 1997-2020	To provide a measure of the long-term growth projection for the county
K-12 enrollment as a percent of population	To provide a measure of the percentage of the population that is currently in the elementary and secondary system
Rate of natural population increase	To guage the growth that can be attibuted to birth-death ratio…This statistic points to long-term growth that will affect higher education in years to come.
Population age 0-17 as percent of the overall population	To provide a measure of the percentage of the population that is in younger age brackets and will affect postsecondary education in the long-term.

Growth Factors. This category of indicators compares the counties in terms of predicted growth as it relates to the concerns of higher education. Long-term growth is highlighted and particular attention is paid to the potential increase in the number of students coming out of the secondary schools in a particular county. One of the challenges of local postsecondary institutions is how to deal with a large bubble of students within a particular area of the K-12 system. Functioning like a mini baby boom, accommodations must be made if a county has a disproportionate number of students age 5 to 18 in the population. Not only will these conditions place a strain on the K-12 system, but they will eventually produce an increase in the number of students seeking or requiring postsecondary training. Because of the long-range planning use of the Educational Needs Index, the growth factor is fairly important and represents 20 percent of the overall ENI score.

Market Factors (10% of ENI)	
Indicator	**Rationale for Selection**
Projected population growth from 1997-2010	To provide a measure of the short-term (immediate) growth being faced by the county
Rate of domestic migration	To guage the growth that can be attributed to people moving into the county from other areas of the state or country…High rates of domestic migration can point to increases in the 18-44 population of the county.
Population age 18-44 as percent of overall population	To provide a measure of the percentage of the population that is within the high-participating 18-44 age group…95% of the current participants in higher education are within this age group
Minorities as a percent of population	To provide a direct measure of the percentage of the population represented by minorities…Concerns for diversity and desegregation efforts in the state require inclusion of this variable to identify potential markets for higher education
Manufacturing employment as a percent of industry	To provide a measure of the reliance upon manufacturing industries within the local economy…Of the various industry categories, manufacturing is the lagging category in terms of projected growth…High percentages of manufacturing employment could trigger t

Market Factors. This category focuses on the short-term needs of the counties and measures current market conditions for postsecondary intervention. Many counties are currently experiencing significant population and economic growth and expect this growth to continue to increase over the next five to ten years. Spikes in the rate of domestic migration into a given county can cause dramatic shifts in the population that require immediate attention by postsecondary institutions. Because many of these new entrants are going to be between the ages of 18 and 44, they represent a “target-market” for higher education. Other demographic and labor indicators are also factored into counties being a target for postsecondary education. When taken as a whole, these market indicators represent 10 percent of a county’s overall educational needs index score.

Population Adjustment Factors (5% of ENI)	
Indicator	**Rationale for Selection**
Percent of Tennessee's population age 0-17	Represents the county's portion of the overall state population to be served
Percent of Tennessee's population age 18-44	Represents the county's portion of the overall state population to be served

Population Adjustment Factors. This final adjustment on the counties' scores allows the relative population weights of each county to be considered. Two measures – the percent of Tennessee's 0-17 population and the percent of Tennessee's 18-44 population – increase the scores of those counties with a "critical mass" of citizens at the age most likely to participate in postsecondary training. If two counties reflect rather high overall needs index scores but there is a 10,000-citizen difference between them, then the larger county shows not only a need for educational intervention but also a larger base of citizens to offer new initiatives.

Results

Using Z-scores allows the county-level data to be compared across variables and reveals the category that shows the county to be most at risk. For instance, it is difficult to make county to county comparison with both "median income data" and the "percent of population with a high school diploma," but we can tell immediately from the data which indicator or factor reveals the most variance from the mean. When variables are measured in different units, a z-score conversion places the variables on a common scale allowing this comparison of individual indicators or factor categories. The average score is always 0 and the standard deviation is 1. In our final index numbers, Williamson County had an overall index score of –1.381 and Hancock County had an overall score of 0.925. These two extremes formed the "bookends" of our rankings with the other 93 counties having index scores between these two figures. Thus we establish a statistically proven, yet simple, way to rank all 95 of our counties using 20 different economic and demographic variables.

The tables to follow show the top and bottom quartile of counties as scored by the overall educational needs index. The top quartile counties represent those counties whose educational levels, economic conditions, growth forecasts, and market conditions combined to suggest critical need for special attention or initiatives from secondary and postsecondary education. The bottom quartile counties represent areas of the state that upon comparison to other counties do not suggest high prioritization.

Rankings of Counties by Educational Needs Index (Top/Bottom Q'tile)							
Rank	County	Education (40%)	Economic (25%)	Growth (20%)	Market (10%)	Population (5%)	Overall Index Score
1	Hancock County	1.416	2.154	-0.469	-0.646	-0.425	**0.925**
2	Union County	1.521	0.314	0.960	0.346	-0.343	**0.896**
3	Hardeman County	0.996	0.934	0.676	0.202	-0.267	**0.774**
4	Campbell County	1.338	1.218	-0.137	-0.564	-0.174	**0.747**
5	Lake County	1.500	1.797	-2.143	0.952	-0.411	**0.695**
6	Grundy County	0.973	1.195	0.240	-0.880	-0.361	**0.630**
7	Scott County	0.304	1.477	0.901	-0.437	-0.306	**0.612**
8	Haywood County	0.417	1.156	0.708	0.245	-0.306	**0.606**
9	Lauderdale County	0.595	0.762	0.705	0.405	-0.270	**0.597**
10	Wayne County	1.020	1.076	-0.604	0.283	-0.345	**0.567**
11	Lewis County	0.483	0.891	0.752	0.181	-0.390	**0.565**
12	Tipton County	0.366	-0.277	2.027	0.672	-0.053	**0.547**
13	Bledsoe County	1.061	0.593	-0.070	0.075	-0.388	**0.547**
14	Fayette County	1.208	-0.157	0.268	0.573	-0.215	**0.544**
15	Morgan County	0.658	0.708	0.224	0.236	-0.318	**0.493**
16	Macon County	0.831	0.405	0.390	-0.146	-0.333	**0.480**
17	Johnson County	0.902	1.522	-1.409	0.253	-0.352	**0.467**
18	Fentress County	0.608	1.597	-0.555	-0.542	-0.349	**0.460**
19	Monroe County	0.688	0.500	0.277	0.099	-0.201	**0.455**
20	Hardin County	0.932	0.604	-0.311	-0.219	-0.283	**0.426**
21	Van Buren County	0.896	0.477	-0.184	-0.019	-0.436	**0.417**
22	Cocke County	0.692	1.121	-0.465	-0.395	-0.224	**0.413**
23	Claiborne County	0.557	0.807	-0.037	0.078	-0.236	**0.413**
24	Grainger County	0.856	0.473	-0.329	0.114	-0.322	**0.390**
25	Meigs County	0.405	0.674	0.215	0.228	-0.400	**0.376**
71	Humphreys County	-0.422	0.012	-0.144	-0.415	-0.347	**-0.254**
72	Maury County	-0.489	-0.918	0.479	0.692	0.099	**-0.255**
73	Madison County	-0.598	-0.535	0.215	0.361	0.258	**-0.281**
74	Wilson County	-0.613	-1.668	1.202	0.556	0.238	**-0.354**
75	Weakley County	-0.232	-0.364	-0.915	-0.095	-0.215	**-0.387**
76	Rutherford County	-1.355	-1.671	1.828	1.524	1.023	**-0.390**
77	Obion County	-0.451	-0.353	-0.386	-0.370	-0.222	**-0.394**
78	Henry County	-0.343	-0.029	-1.024	-0.411	-0.263	**-0.403**
79	Unicoi County	-0.293	0.010	-1.114	-0.536	-0.350	**-0.409**
80	Bradley County	-0.809	-0.776	0.229	0.172	0.201	**-0.445**
81	Hamblen County	-0.675	-0.455	-0.265	-0.069	-0.047	**-0.446**
82	Franklin County	-0.590	-0.391	-0.409	-0.474	-0.181	**-0.472**
83	Moore County	-0.525	-1.180	0.354	-0.481	-0.436	**-0.504**
84	Sumner County	-1.192	-1.612	1.438	0.519	0.596	**-0.510**
85	Blount County	-0.890	-0.866	-0.362	0.069	0.319	**-0.622**
86	Davidson County	-1.077	-1.305	-0.435	-0.040	4.134	**-0.641**
87	Roane County	-0.933	-0.287	-0.721	-0.500	-0.097	**-0.644**
88	Coffee County	-1.447	-0.484	0.488	-0.390	-0.108	**-0.647**
89	Putnam County	-1.513	-0.491	-0.172	0.305	-0.002	**-0.732**
90	Sullivan County	-1.182	-0.664	-0.770	-0.544	0.679	**-0.814**
91	Hamilton County	-1.466	-0.901	-0.416	-0.355	1.958	**-0.833**
92	Washington County	-1.413	-0.644	-0.739	-0.103	0.335	**-0.868**
93	Knox County	-1.868	-0.982	-0.541	-0.168	2.555	**-0.990**
94	Anderson County	-1.829	-0.802	-0.249	-0.510	0.085	**-1.029**
95	Williamson County	-2.712	-3.319	2.037	1.000	0.535	**-1.381**

Using Hancock County as an example, the data can be interpreted by looking at each of the four factor scores. Hancock County received rather high factor scores in the educational (1.416) and economic (2.154) categories, but lost index points in the growth and market categories. The county's long-term growth factor (-0.469) and market strength (-0.646) bring its overall index score down to 0.925. Even with that reduction, Hancock still is well ahead of Union County with an overall score of 0.896. Hancock's severe educational attainment numbers and economic conditions provide it with enough points to overcome any forecasts on growth or market potential. In short, educational intervention needs to occur in Hancock County regardless of whether the county could be considered a rich target environment for postsecondary education.

To demonstrate the extreme of Hancock County, look to the data associated with Williamson County which ranked 95th on the index. Williamson County has extremely strong educational and economic variables as compared to its peers which results in extremely low factor scores. However, Williamson does manage to pick up some points for its strong growth statistics (2.037) and market indicators (1.000) though not enough to overcome its already strong position relative to other counties. One pattern that immediately emerges in the bottom quartile of scores is the disproportional representation of the "metropolitan areas" of Tennessee. A map showing the counties with the highest index scores will show that very few of the most critical counties are near metropolitan areas (Appendix). The appendix section includes other maps that sort out the most critical counties by individual factor scores.

Conclusions

Education and training are accepted as the primary paths for investing in human capital, also referred to as "people potential." Growth economists have stated that human capital presently contributes more than physical capital (technology, infrastructure, etc.) to economic development and expansion. Business and industry rely upon two sources to boost the state economy – new entrants to the workforce and the current workforce. Increasingly, both in Tennessee and across the nation, new entrants to the economic system are individuals from disadvantaged backgrounds. Policies that deter members of disadvantaged groups from the postsecondary system run counter-productive to economic development goals because these potential students are also future contributing taxpayers and active citizens in their respective communities.

To raise participation rates and educational attainment, postsecondary education leaders need to better understand the aspirations of potential students and the market forces influencing these citizens. This research answers the call of Meulemeester and Rochat (1995) to provide a nexus between the scholarly and policy worlds. This model incorporates educational, economic, growth, and market variables in each of the 95 counties of Tennessee. The results provide practical, concise, and generalizable results that will be used to better inform planning for delivery of all levels of education to the citizens of Tennessee and will provide great insights for a variety of audiences, including planners, institutional researchers, recruitment coordinators, legislators, and policy makers. Finally, by employing a broad set of economic and demographic indicators, the index approach answers the call to bring the best of what is known about human capital from a variety of disciplines and focus policy debate on their combined relevance to crucial educational and economic decisions (Walberg & Zhang 1998).

It is the sincere hope of the authors of this study that the result will be used to better inform the policy development process, and to clearly articulate the importance if higher education for the future of Tennessee and other states. As Bosso (1997) noted, one of the primary responsibilities of government is to allocate as much of their fiscal resources as possible to education. No other social program demonstrates the tangible rate of return as education. In an era in which many states are more concerned with building prisons than schools, scholars have a responsibility to use the results of their research to educate policy-makers. The failure of communities to invest adequately in human capital is the most important cause and the most tragic effect of poverty in the United States. The failure of many states to invest in education has condemned impoverished children to lifelong poverty through succeeding generations (Hill 1998). If Tennessee and other underdeveloped states are to ever realize their potential, they must make the commitment to education.

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